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PROFESSIONAL TRAINING IN ENTOMOLOGY*

BY M. A. STEWART
University of California, Berkeley

From time to time papers have been written and speeches have been delivered concerning the teaching of entomology and committees have been appointed to study the problem of training entomologists. However, little or no action has resulted from these efforts to rationalize the professional education of entomologists and to develop reasonably uniform curricula of high standards comparable to those required of students in the older professions. Curricula in entomology, even those generally regarded as being among the best, have developed, in very large part at least, more or less under the stimuli of personal interests of prominent faculty members, rather than as the result of careful and exhaustive studies of the legitimate demands upon, and the responsibilities of, the profession of entomology and the consequent needs of the student. No whole-hearted and successful attempt has been made to standardize, within reasonable limits, the curricula in entomology in the leading universities, which should result ultimately in the adoption of similar programs of study by the smaller and less well endowed institutions. As a consequence of this somewhat *laissez faire* attitude and failure to develop rigidly professional and more or less uniform curricula, young entomologists graduating from different colleges manifest a remarkable dissimilarity in philosophy of their science, in magnitude and character of information and even in appreciation of their responsibilities and opportunities.

The education of students of entomology is a matter of pertinent concern to teacher upon whom is imposed the responsibility of well equipping these young people for successful and competent careers and of anticipating new demands upon entomologists as the scope of the profession expands and as new approaches and new interrelationships with other fields of science develop as a consequence of the normal evolution of the profes-

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sion. Furthermore, responsibility for maintaining, and increasing wherever possible, the standards and competency of professional entomology largely and inevitably rests upon the teachers. Entomological education obviously is of paramount importance to students who are preparing to enter the profession and who rightfully expect their teachers and institutions to equip them well for the career upon which they intend to embark. The training of students of entomology is equally important to entomologists who are engaged exclusively in research, regulatory work and other entomological occupations distinct from teaching, since they not only have a natural interest and pride in the profession of which they are members, but also have the responsibility of hiring from time to time young entomologists of whom they expect adequate qualifications. Finally, the general public which financially supports entomology is justified in expecting, and even demanding, thoroughly competent entomologists and entomological service of the highest calibre. Thus we see that the education of students of entomology is an extremely pertinent matter to both professional workers, actual and potential, and to the general public. Particularly must the teachers and the colleges consciously recognize the *noblesse oblige* that is inescapably theirs.

In order to properly appreciate and evaluate the problem which confronts us, we may ask ourselves certain fundamental questions.

The first basic question to answer is what is an entomologist? This question can be answered simply by stating that he is a person engaged in the study of the accumulated and accepted knowledge of insects and certain other arthropods with reference to the discovery of general truths or the operation of general laws and in adding to this knowledge and making practical applications of it. However, for the more thorough appreciation and evaluation of the problem of professional training in entomology, it is better to erect a more complete definition which recognizes that an entomologist is first a biologist, second a zoologist and finally an entomologist. This more basic concept emphasizes the true position of the entomolgist as a scientist and more clearly indicates the exact nature and magnitude of his specialized training. It should be obvious that failure to accept such a point of view will inevitably result in imposing upon the student restrictions which will narrow the scope of his activities in contributions to

his field of science. The acceptance of this definition elucidates the extent of specialized education concerned directly with entomology, and without regard to the correlated subjects, demanded for true professional status. Extending the definition to completion, one must accept the fact that entomology is so complex as to necessitate subdivision into the specialized fields of systematics and the several aspects of applied entomology.

The second question that must be satisfactorily answered is, what are the responsibilities of entomology as a profession? The most readily apparent reply is that entomology is concerned with the protection of man's food and clothing, much of his financial investment and his health and that of his domesticated animals from the direct and indirect ravages of arthropods. It is also responsible for the possible furtherance of the effectiveness of insects beneficial to man and his interests. A moment's reflection presents the fact that entomologists engaged exclusively in what is called, for the sake of convenience, applied entomology are not able to completely discharge their responsibilities alone. Systematists should be working in closest collaboration with such entomologists and supplying them with basic information.

Since, by previous definition, entomology in part is also concerned with the discovery of general truths and the operation of general laws, responsibility rests upon the profession for training competent workers in taxonomy and encouraging adequate museum facilities and for providing personnel for bionomic and other systematic studies and investigations. These entomologists together with the economic workers effect the compilation of scientific entomological knowledge.

A third type of responsibility is met by providing professionally trained entomologists for research and service in the insecticide industry.

It is manifest that in each of these general aspects of entomology, which jointly share the professional responsibilities, there are numerous highly developed specialties. At a casual glance it might appear that these specialties are rather distinct and narrowly restricted. Such a concept is entirely erroneous. It is highly urgent that each specialist be sufficiently thoroughly trained in entomology and allied basic subjects and indoctrinated with the broad scientific point of view to have a good working knowledge and sound appreciation of the other fields of entomological specialization. The degree of individual competency

and ethical success of the profession is in direct proportion to the completeness and rationality of the professional training afforded to the student.

The preceding statements and analyses are admittedly not new and are elementary, but it is necessary to review the concepts they express and to keep them in mind constantly if the current requirements for professional status in entomology are to be critically examined and if a rational approach is to be made to the problem of future improvements in entomological education.

Before advancements can be made in the professional training of entomologists, with consequent elevation of standards and greater competency in discharging ethical professional obligations, the faults and deficiencies in prevailing entomological curricula must be recognized.

Perhaps the most prominent fault in our curricula is failure to recognize clearly the truly professional status of entomology and to treat it accordingly. It is true that we speak of the profession of entomology, but not with a full and conscious realization of the significance of the term and recognition of the responsibilities membership in it incurs. We have not benefited by the educational experiences of the older professions such as medicine, law and chemistry. Failure to profit by the experience and history of older and comparable fields of effort inevitably results in some retardation of progress. Not one of the older professions would accept new students to more or less full status late in their undergraduate years, or omit a rather definite schedule of prerequisites, or permit widely dissimilar courses of study, or fail to differentiate between pre-professional and professional courses. Departments of instruction in entomology, however, are guilty of all of these educational misdemeanors.

Another fault in entomological education is failure to view the field as a whole and as a distinct discipline with necessary ramifications and delimitations. This is a reflection of a weakness in recognition and appreciation of the fundamental and scholarly philosophy upon which the profession must be based. Such definitions as are presented earlier in this paper must be accepted and abided by to avoid this serious pitfall of omission. Lack of clearly defined concepts and goals and logical approaches to these goals inhibit, if not prohibit, the attainment of adequate curricula and professional competency.

The absence of some reasonable degree of standardization of

entomological curricula constitutes a serious obstacle in developing consistently entomologists of truly professional calibre. Anyone who has ever been concerned with the teaching of entomology at the graduate level has been strongly impressed by the great divergencies in the character and magnitude of undergraduate curricula in different universities. The obvious result of such a lack of standardization of curricula is that the employer of young entomologists must pay undue attention to the school from which an applicant graduates, and even to the professors under whom he studied, and cannot assume, making exceptions for normal differences in native intelligence, industry and integrity, that almost all young graduates in entomology are more or less equally competent professionally.

It is deplorable that nearly every department of entomology in the United States fails to differentiate in practice, if not in regulations, between undergraduate or pre-professional and graduate or professional courses. One finds a remarkable hodgepodge of courses upon examination of the curriculum for a given semester, or year, of almost any student in entomology. This is, perhaps, particularly true of the graduate student, who frequently is taking concurrently one or more undergraduate courses and courses of the most advanced nature.

Because of an apparent inability to recognize that entomology is a distinct discipline and must be treated accordingly, even though it may transect or be intimately correlated with many other fields, or even a group of fields as well exemplified by the relationship between entomology and agriculture *per se,* there is often indecision as to what subjects should be required in the curriculum and even sometimes vitally essential courses are sacrificed because of a mistaken conviction that certain other courses should be required. It must be recognized that the first responsibility of the department of entomology and the first obligation to the students is that of adequate training for competency in the precise discipline of entomology as a profession and that other courses are of secondary importance, except those which are actually basic to entomology and those which should be reasonably expected as a part of the cultural education that should be claimed by and demanded of every college graduate.

A laxity in the matter of prerequisites has already been suggested in the comparison made between departments of entomology and departments or schools training students in the older

professions. The most serious neglect to prerequisites occurs not so much in the courses in entomology as in the proper sequence and correlation of basically important courses outside of those restricted to entomological studies and upon which thorough competency in entomology depends and also of prerequisites to eligibility for admission to graduate school and adequacy for instruction at the graduate level. It is almost the rule, rather than the exception, to see graduate students in entomology pursuing studies which should have been completed during undergraduate years. It is indeed tragic that such an easily solved problem persists even in our better institutions.

Partly because of lack of accurate appreciation and understanding of the discipline of entomology as a science, partly because of lack of properly organized curricula, partly because of lack of serious study of the needs of the student preparing for a professional career in entomology and partly because of failure on the part of teachers to anticipate probable future demands upon entomology we find, perhaps more frequently than not, a deplorable lack of breadth of training in our entomologists, not only in the more narrowly restricted science of entomology itself but more especially in the basic fields upon which entomology is dependent. It is doubtful if there is a mature entomologist who does not regret that his own training is so conspicuously deficient in certain fundamental things in which he should have been trained as a student. This does not refer necessarily to those fields that have become important recently as a consequence of evolution of the profession, but to those subjects which should have constituted logically a part of his education at the time he was a student. Breadth of training not only in entomology *per se*, but also in related fields basic to or closely correlated with such professional training are especially urgent for the potential entomological investigator.

This is not the place nor the time to present anything that pretends to be a complete or definite curriculum for students who desire to qualify as professional entomologists. Obviously such a curriculum can be erected only from intense and exhaustive study and should be the product of a carefully selected group of experienced teachers. However, it is clear that the difference between undergraduate and graduate instruction should be clearly defined and understood. No thoughtful modern entomologist would endorse the idea that undergraduate training

alone qualifies a student as a professional entomologist. The master's degree has long been, and still is, a perplexing problem to the educator; but we are probably justified in assuming that it satisfies some need in entomological training. It is an irrefutable fact that modern professional demands are such that it is extremely difficult and probably will soon become impossible for the young man or woman to attain full professional status in entomology without first achieving the degree of Doctor of Philosophy or its equivalent. From these facts one may justifiably accept some such concept as the following relative to entomological education. The undergraduate curriculum may well be considered a pre-professional course, *i. e.* a pre-entomological course, in which the student is afforded the opportunity to acquire adequate preparation for instruction at the graduate level and, at the same time, the cultural education that should be demanded of every graduate of a reputable college or university. As indicated above, the master's degree is something of an enigma but might be considered a legitimate and creditable attainment for the student who intends to enter regulatory work or to fill some commercial or industrial entomological niche at a sub-professional level. The graduate training directed toward earning the doctorate must be intensive work of a very high scholastic character, fulfilling truly professional criteria. Such a philosophy of instruction demands a carefully planned progressive and coordinated program with a clear understanding of the distinction between the pre-professional character of the undergraduate curriculum and the professional stature of the graduate studies.

As previously indicated, no attempt is being made in the present discussion to erect curricula for professional training in entomology; but certain salient and fundamental points may well be mentioned briefly. Manifestly, the student requires as much and as thorough training in entomology as possible. However, the usual tendency to compress the greater part, if not all of this, into the undergraduate years should be avoided. Instead thereof, these courses should be logically and progressively correlated and arranged to extend throughout the four years of pre-professional training and well into the graduate years of study, leaving ample time for the undergraduate student to take adequate course work in allied scientific subjects and necessary and desirable cultural courses. Such a recommendation immediately

raises the problem of the student who decides relatively late in his undergraduate course to enter professionally the field of entomology. There is only one rational and ethical answer to this problem and that is to insist that such students fulfill completely the established requirements regardless of the fact that they may be penalized in many instances by the necessity of devoting one or more additional years to the attainment of a bachelor's degree. Failure to adhere to such rigid requirements and definite program can result only in the lowering of the professional standards. The older professions of medicine, law, and chemistry have long ago recognized the necessity and wisdom of such an attitude.

During the undergraduate years the student should receive thoroughly adequate training in zoölogy and botany and in physics and chemistry. However, if studies of the development of the entomological curriculum so indicate, the more advanced required courses in chemistry might be extended into the graduate training. Genetics, plant pathology and plant physiology should be required of the pre-professional student. One of the greatest crimes being committed in entomological education today is permitting the very frequent occurrence of postponement of studying French and German until the student has matriculated in the graduate school. The usual result of this is that the student learns barely enough of these languages to satisfy a lenient examiner and never is able to read French and German accurately and easily. Certainly every student who intends to become a professional entomologist should be required to become competent in reading these languages before begininng graduate studies. The entomological investigator has urgent need of at least a working knowledge of statistical analysis. Consequently mathematics through statistical analysis should be required; if necessary to prevent the overcrowding of the undergraduate curriculum, the advanced work may be covered during graduate instruction. Elementary economics, at least, might well be required of the student in entomology and competency in English should be demonstrated before admission to graduate standing. Most educators recognize and deplore the astounding ignorance of the fundamentals of the English language manifested by a considerable proportion of graduate students in entomology. Undeniably the professional entomologist who is unable to speak and write well and accurately is severely handicapped. In addition to the subjects previously mentioned, the undergrad-

uate student should have as broad a training as at all feasible in the social sceinces and the humanities and thereby enjoy the dignity and prestige of the educated man, an inescapable responsibility of every reputable college and university regardless of the specialized curriculum of the individual student. To insure the discharge of this responsibility and the consequent dignity of the entomological profession, the departments of entomology might very well arrange these cultural subjects into logical groups and require each student to satisfy certain minimum requirements in each group. Admittedly such a schedule would curtail the students' usual freedom of choice in the matter of electives, but is such a restriction undesirable? It can be strongly argued that closer direction of the undergraduate's selection of elective subjects is highly desirable because of his own necessarily limited ability to evaluate courses and to appreciate problems of subject correlations and the necessity of broad professional and cultural perspectives. Furthermore, closer regulation of electives will result in the student profiting more from the considered judgment of the mature scholar.

Some will wonder, and even challenge, why courses in agriculture *per se* are omitted from the general consideration of an entomological curriculum as presented above. The most important reason for this omission is that an entirely adequate program for the training of students in entomology up to the truly professional level does not permit, in the space of seven or eight years of college study, the inclusion of much in the way of strictly agricultural subjects without sacrificing other courses of urgent and greater importance to entomology as a distinct profession. Another reason for this point of view is that agricultural practices are constantly developing and changing and what the student learns in college of these things is frequently out-dated within a period of very few years; such a condition does not justify overcrowding or infringing upon an already heavily burdened and exacting curriculum. Finally, the actual need of courses in agriculture is questionable since experience has shown that the fundamentals and the practical details necessary to the entomologist in his investigations in agricultural entomology and his recommendations for insect control are easily and quickly acquired in the course of early professional duties through conferences with and advice of cooperating agricultural specialists.

Thus far no mention has been made of the graduate student's

research and dissertation. It is sufficient here to point out that the fundamental purpose of this aspect of graduate requirements is to acquaint the student, on a broad plane, with research methods and to afford him an opportunity to demonstrate his ability to organize and conduct research and to properly and adequately handle the results obtained from such investigations. If the teacher recognizes the implications contained in such a concept of the dissertation, he will immediately appreciate the serious thought that must be given to the selection of a research problem for the graduate student and the careful and discreet guidance that he must give to the student. Too frequently, the research problem is either carelessly or thoughtlessly chosen or is selected to further the professor's own research, either of which should disqualify the professor for the privilege and responsibility of directing graduate students.

The problems presented in this discussion are urgent and of major importance if the scholarly and scientific heritage of the field of entomology is to be preserved and is to serve as a source of inspiration to future entomologists as it has been to those of the recent past and if entomology is to deserve the dignity of a professional status.

TWO COLEOPTERA RECENTLY ESTABLISHED IN SOUTHERN CALIFORNIA

Conoderus laurentii (Guer.) This West Indian elater was accidentally introduced into Florida and Alabama at least forty years ago and is now well established there. On August 2, 1938, I received a specimen of the same from E. Herald, taken on his lawn in Los Angeles and on October 15, 1944, another specimen collected by Mrs. Barbara Prendergast, at Hollywood. According to Prof. Ralph H. Smith, this species is now fairly well established in lawns in various places in southern California.

Staphylinus (*Goerius*) *olens* Müll. A common European species, generally listed as *Ocypus olens* Müll. in most insect works, was first noticed at Hollywood, April 16, 1936, and West Los Angeles in November, 1940, and more recently found in abundance in various places near the Campus of the University of California at Westwood, Los Angeles, according to Prof. R. H. Smith. These are, I believe, the first records for this species in this country. Fortunately it is a beneficial insect.—EDWIN C. VAN DYKE.